

Assignment 1

Textbook Assignment: "Fundamentals of Meteorology"; "Atmospheric Physics." Pages 1-1-1 through 2-3-5.

Learning Objective: Define terms and recognize units of measure used in the metric and English systems.

- 1-1. The metric (cgs) system has been adopted by meteorologists to measure units of
 1. gravity, density, and force
 2. length, weight, and time
 3. centimeters, grams, and seconds
 4. circular motion, gravity, and speed
- 1-2. A dekameter is equivalent to approximately how many feet?
 1. 3.28 ft
 2. 3.93 ft
 3. 39.3 ft
 4. 32.8 ft
- 1-3. Approximately how many inches are there in 25 centimeters?
 1. 0.984 in.
 2. 9.840 in.
 3. 98.400 in.
 4. 984.000 in.
- 1-4. Weight and mass are synonymous, except one is English and the other metric.
 1. True
 2. False
- 1-5. A dyne is a measure of
 1. length
 2. force
 3. area
 4. density

Learning Objective: Describe solar features and the Sun-Earth relationship.

- 1-6. Earth receives the majority of its heat from the Sun. What percent is NOT received from the Sun?
 1. 1.0%
 2. 0.1%
 3. 0.3%
 4. 0.5%
- 1-7. What are solar winds?
 1. Winds generated on Earth by the Sun's appearance above the horizon
 2. Streams of solar particles emitted from the Sun's surface
 3. Winds generated by the pressure differences between hot and cool spots on the Sun's surface
 4. Interplanetary winds created by the constellations
- 1-8. What are sunspots?
 1. Hot spots known as solar flares
 2. Irregular bright patches on the Sun's surface
 3. Areas where the convective zone is exposed
 4. Regions of strong localized magnetic fields
- 1-9. It takes Earth approximately 365 1/4 days to circle the Sun. Approximately how many times will Earth rotate about its own axis during this time?
 1. 15 1/4
 2. 30 1/2
 3. 182 1/2
 4. 365 1/4
- 1-10. In the Southern Hemisphere, on or about what date will the greatest amount of incoming solar radiation be received?
 1. January 21
 2. March 21
 3. June 21
 4. December 22

- 1-11. The Sun's most direct rays reach their poleward limit twice in the year. What dates and names mark these occurrences?
1. March 21 and September 22; the spring and autumnal equinoxes
 2. June 21 and December 22; the summer and winter equinoxes
 3. March 21 and September 22; the spring and autumnal solstices
 4. June 21 and December 22; the summer and winter solstices
- 1-12. Which of the following statements is/are correct concerning latitude 23 1/2° N?
1. It is known as the Tropic of Cancer
 2. It is the northern extent of the Sun's most direct rays
 3. It represents one-half of the total range of motion of the Sun's most direct rays
 4. All of the above
- 1-13. The temperate zone in the Southern Hemisphere receives sunshine all year, but receives more sunshine when winter is being experienced in the Northern Hemisphere.
1. True
 2. False
- 1-14. If the Sun's radiation (Earth's incoming solar radiation) was not dispersed or filtered, Earth would eventually become too hot for life to exist as we now know it. Which of the following factors plays the major role in dispersing Earth's insolation?
1. Scattering
 2. Earth's inclination
 3. Earth's rotation
 4. Reflection
- 1-15. Earth's average albedo is between 36 and 43 percent. Which of the following terms most accurately defines albedo as it pertains to Earth and its atmosphere?
1. Sky cover
 2. Scattering capability
 3. Absorption capability
 4. Reflective capability
- 1-16. What percentage of Earth's insolation is absorbed by land and water?
1. 13%
 2. 36%
 3. 43%
 4. 51%
- 1-17. Through its atmosphere's ability to absorb and lose heat, Earth enjoys an average temperature of 15°C/59°F. If it failed to absorb short-wave radiation and radiate long-wave radiation, Earth's average temperature would be
1. -04°F
 2. -04°C
 3. -35°F
 4. -35°C
- 1-18. The poles receive far less incident radiation than the equator. What is the effect on a polar air column in relation to a column of air over the equator?
1. It is more shallow and lighter
 2. It is more shallow and heavier
 3. It is thicker and heavier
 4. It is thicker and lighter
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- Learning Objective: Describe how pressure is measured and determine how the atmosphere is affected by pressure.
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- 1-19. Which of the following sea level pressure(s) is/are the standard used by the International Civil Aeronautical Organization?
1. 1013.25 millibars
 2. 29.92 inches of mercury
 3. 14.7 lbs per square inch
 4. All the above
- 1-20. With a sea-level pressure reading of 1000 mb, one would expect the pressure at 18,000 feet to read
1. 200 mb
 2. 300 mb
 3. 500 mb
 4. 750 mb
- 1-21. Pressure readings vary to the greatest degree with changes in
1. latitude
 2. altitude
 3. temperature
 4. humidity
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- Learning Objective: Mathematically convert temperature readings.
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1-22. Convert 18° Celsius to Fahrenheit.

1. 85°F
2. 74°F
3. 64°F
4. 57°F

1-23. Convert 91° Fahrenheit to Celsius.

1. 27°C
2. 30°C
3. 33°C
4. 36°C

1-24. Minus 5° Celsius equates to what Kelvin (K) scale temperature?

1. 250°K
2. 268°K
3. 278°K
4. 283°K

Learning Objective: Describe the thermal structure and other characteristics of Earth's atmosphere.

1-25. Which of the following statements is/are correct concerning the troposphere?

1. Temperature inversions are not uncommon
2. Its thickness varies with latitude
3. Its thickness varies with the seasons
4. All of the above

1-26. For meteorological purposes, Earth's atmosphere is classified into zones or layers by its thermal structure. Working upward through the atmosphere, which of the following lists of zones is correct in its vertical order?

1. Troposphere, tropopause, mesosphere, mesopause
2. Troposphere, stratosphere, mesosphere, exosphere
3. Mesosphere, mesopause, thermosphere, exosphere
4. Stratosphere, mesosphere, exosphere, thermosphere

1-27. On some atmospheric soundings, it is sometimes possible to have more than one tropopause recorded.

1. True
2. False

1-28. The rise in temperature in the upper portion of the stratosphere is attributed to

1. the absence of water vapor
2. excessive amounts of water vapor
3. the presence of ozone
4. its relative closeness to the Sun

1-29. Which of the following zones marks the outer limit of Earth's atmosphere?

1. Mesosphere
2. Troposphere
3. Stratosphere
4. Exosphere

1-30. Which of the following zones is an electrical classification?

1. Exosphere
2. Mesosphere
3. Troposphere
4. Thermosphere

Learning Objective: Define and describe the methods of heat transfer.

1-31. At night, the Earth's surface radiates some of the heat it gains during the day, and it cools. By what process does the layer of air in contact with the Earth's surface cool?

1. Radiation
2. Conduction
3. Convection
4. Advection

1-32. The specific heat of water is 1. What does 1 represent?

1. The temperature of the water
2. The calorie requirement to raise the temperature of 1 gram of water 1° Celsius
3. The weight of the substance used in the ratio
4. The time requirement (in minutes) to raise the temperature of 1 gram of water 1° Celsius

1-33. The horizontal transport of heat is known as

1. radiation
2. conduction
3. convection
4. advection

Learning Objective: Describe water vapor (moisture) characteristics and show how moisture affects the atmosphere.

- 1-34. Earth's atmosphere is capable of holding more water vapor (water in its gaseous state) at which of the following latitudes?

1. 5°N
2. 30°N
3. 60°N
4. 80°N

- 1-35. Which of the following statements concerning saturation is correct?

1. Water vapor does not exist in a volume of the atmosphere that is saturated
2. To saturate air at the Earth's surface requires less water vapor per unit mass than at 500 mb.
3. The degree of saturation is dependent on pressure
4. If equal amounts of water vapor are imputed into the atmosphere, saturation is more likely to occur in polar regions before it occurs in equatorial regions

- 1-36. Which of the following occurrences will result in the condensation of water vapor?

1. Air moved over a colder surface
2. Air lifted mechanically
3. Air cooled by the radiational cooling process
4. Each of the above

- 1-37. You hear someone say that it is very humid outside (high relative humidity). What does this statement imply?

1. It is very hot out
2. Precipitation will occur
3. Water vapor content is diminished
4. The air is very moist

- 1-38. To determine the degree of saturation of the air, you must compute

1. absolute humidity
2. specific humidity
3. relative humidity
4. mixing ratio

- 1-39. In a given mass of dry air, the ratio of the mass of water vapor to the given mass of dry air is expressed in grams per gram or grams per kilogram and is known as the

1. mixing ratio
2. specific humidity
3. saturation mixing ratio
4. relative humidity

- 1-40. Under which of the following conditions will the specific humidity of unsaturated air change?

1. Temperature changes
2. Pressure changes
3. Air is compressed
4. Water vapor content changes

- 1-41. Knowing that the mixing ratio of a parcel of air is 6.3 g/kg and the saturation mixing ratio is 9.0 g/kg, what is the relative humidity of the parcel?

1. 56%
2. 63%
3. 70%
4. 90%

- 1-42. Which of the following statements concerning dewpoint is most correct?

1. Saturation only occurs if the air temperature is cooled to its dewpoint
2. Saturation only occurs if the air temperature is increased to its dewpoint
3. Saturation occurs if the air temperature is cooled to its dewpoint and there are corresponding changes in the pressure and water vapor content
4. Saturation occurs if the air temperature is cooled to its dewpoint and the pressure and water vapor content do not change

Learning Objective: Describe the laws of motion and how motion is affected by external forces.

- 1-43. A tropical depression moved 360 nautical miles in 24 hours. This movement is referred to as

1. acceleration
2. speed
3. velocity
4. inertia

1-44. A low-pressure center is stationary over the south-central North Atlantic Ocean for three days. On day four, the low moves 250 miles north. Which law of motion applies to the low's change in position?

1. Newton's first law
2. Newton's second law
3. Newton's third law
4. Dalton's law

1-45. A stationary high-pressure center begins to move, and in 12 hours, the upper-level winds move the center 60 nautical miles. What property did the high exhibit when it was stationary, and what was necessary to move it 60 nautical miles?

1. Acceleration and inertia
2. Inertia and acceleration
3. Inertia and work
4. Kinetic energy and potential energy

1-46. A destroyer is dead in the water. Which of the following forces is NOT acting upon the ship?

1. Gravity
2. A contact force
3. An at-a-distance force
4. A resultant force

1-47. A line that represents magnitude and direction is known as a

1. force
2. composite force
3. vector
4. contact force

1-48. Your ship is moving south (180°) at 15 knots, and the apparent wind reads 090 degrees at 05 knots. What is the true wind, and what name defines the forces used to compute it?

1. 160/16, component
2. 160/16, resultant
3. 340/20, component
4. 340/20, resultant

Learning Objective: Recognize the affects of pressure, density and temperature on Earth's atmosphere, and the application of the gas laws in meteorology.

1-49. What two basic particles make up the composition of all matter?

1. The atom and molecule
2. The molecule and element
3. The compound and mixture
4. The element and atom

1-50. When elements and compounds exist together without forming new compounds, they are known as a

1. mixture
2. compound
3. compounded element
4. state

1-51. Which of the following forms of matter are called fluids?

1. Solids only
2. Liquids only
3. Gases only
4. Liquids and gases

1-52. Air density can be critical to a pilot whose aircraft must take off on a short runway and/or whose aircraft is heavily loaded. Which, if any, of the following factors affects the density of the air at a given location?

1. Pressure only
2. Temperature only
3. Pressure and temperature
4. None of the above

1-53. On a warm summer morning, cumulus humulus forms at 2000 feet. By mid-afternoon, water droplets in the base of some of the cumulus are being lifted in convective currents. When these droplets rise above the freezing level, they crystallize (freeze) and remain frozen until they enter a downdraft and encounter a layer of non-freezing temperatures. In the non-freezing temperatures melting begins. In what order did the changes of state take place in this evolution?

1. Liquid to solid, solid to liquid, and liquid to vapor
2. Vapor to liquid, liquid to solid, and solid to vapor
3. Vapor to solid and solid to vapor
4. Vapor to liquid, liquid to solid, and solid to liquid

IN ANSWERING QUESTIONS 1-54 THROUGH 1-57, MATCH THE DESCRIPTION OF CHANGE IN COLUMN B WITH THE CHANGE OF STATE IN COLUMN A.

	A. CHANGES OF STATE	B. DESCRIPTIONS OF CHANGES	
1-54.	Fusion	1. Liquid to solid	1-63. How do the molecules of helium in a pressurized bottle of helium move?
1-55.	Condensation	2. Solid to liquid	1. At varying speeds in straight lines
1-56.	Evaporation	3. Vapor to liquid	2. At varying speeds in a random manner
1-57.	Freezing	4. Liquid to vapor	3. At a constant rate of speed in a random manner
1-58.	What is the name given to heat that is given off or absorbed in a substance's change of state?		4. At a constant rate of speed in straight lines
	1. Energy		1-64. Which, if any, of the following relationships concerning enclosed gases is correct?
	2. Fusion		1. Increasing the temperature decreases the pressure
	3. Freezing		2. Increasing the temperature and decreasing the volume decreases the pressure
	4. Latent		3. Decreasing the volume decreases the pressure
1-59.	Water molecules in the oceans are more apt to move into the atmosphere at which of the following latitudes?		4. None of the above
	1. 5°S		1-65. Boyle's law and the Universal gas law are very similar except
	2. 25°S		1. temperature is not considered in the Universal gas law
	3. 25°N		2. pressure is not considered in Boyle's law
	4. 60°N		3. the Universal gas law applies to the free atmosphere vice enclosed gases
1-60.	You are with someone who is wearing glasses in an air-conditioned space. When you leave the space and go outside into much warmer air, the person's glasses fog over. What process has taken place?		4. Boyle's law is dependent on a constant temperature
	1. Evaporation		1-66. To what does the gas constant in the Equation of State apply?
	2. Condensation		1. Pressure
	3. Sublimation		2. Temperature
	4. Fusion		3. Volume
1-61.	Just after reveille, you go up on deck and find the rails and outer bulkheads wet. There has been no precipitation or fog, and the winds and sea have been relatively calm. To what do you attribute morning dampness?		4. Molecular weight
	1. Humidity only		1-67. Which of the following factors is considered in the Equation of State, but not in Boyle's, Charles' or the Universal gas laws?
	2. Humidity and condensation		1. Density
	3. Evaporation only		2. Temperature
	4. Humidity and evaporation		3. Volume
1-62.	All cirriform clouds form through the process of sublimation.		4. Pressure
	1. True		1-68. The molecular weight of dry air is greater than moist air. How do their densities compare?
	2. False		1. Moist air is more dense than dry air
			2. Moist air is less dense than dry air
			3. Moist air is occasionally more dense than dry air
			4. Moist air and dry air do not differ in their density

Learning Objective: Recognize pressure, temperature, and density effects on the atmosphere.

1-69. What is/are the purpose(s) of the hypsometric equation?

1. To reduce pressure
2. To determine the thickness between two layers
3. Both 1 and 2 above apply
4. To determine pressure and temperature variations

1-70. What is the approximate thickness of the 1000-500-mb layer when the layer has a mean temperature of -10°C ?

1. 5,140 meters
2. 5,097 meters
3. 4,878 meters
4. 4,778 meters